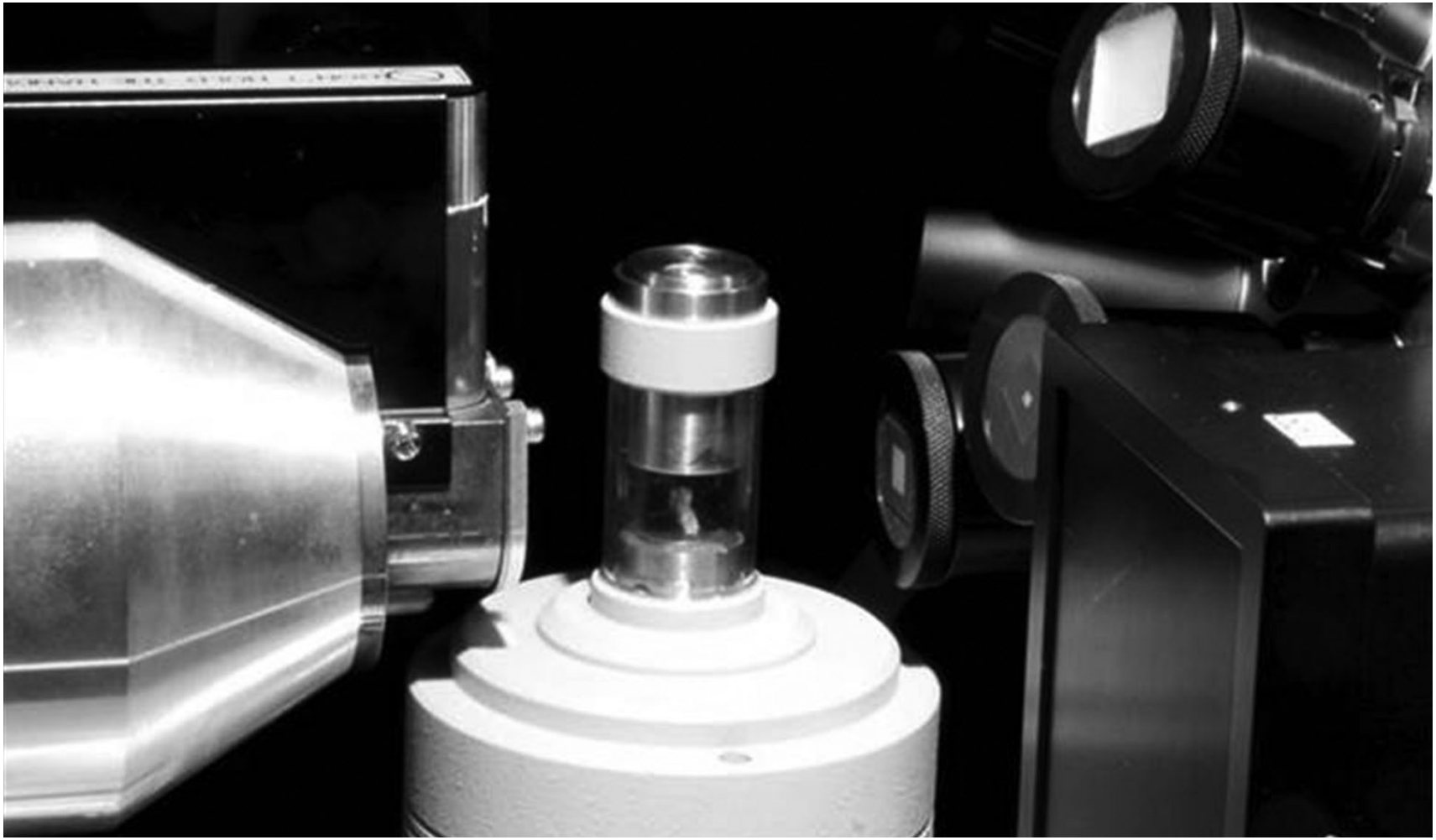


Product Information
Version 1.0

ZEISS Xradia 410 Versa

Submicron X-ray Imaging:
Bridging the Gap in Lab-based Microscopy

We make it visible.

3D X-ray Microscope –
A Workhorse Solution for 3D Submicron Imaging

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

The Xradia 410 Versa bridges the gap between high-performing X-ray microscopes and less powerful, lower-cost computed tomography (CT) systems. Delivering non-destructive 3D imaging with industry best resolution, contrast, and in situ capabilities, the Xradia 410 Versa promotes groundbreaking research for the widest range of sample sizes. A powerful, cost-efficient "workhorse" solution, the instrument enhances the imaging workflow in diverse lab environments.

ZEISS Xradia 410 Versa: Simpler. More Intelligent. More Integrated.

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

Extending the Boundaries of Science
The Xradia 410 Versa X-ray microscope delivers cost-efficient, flexible 3D imaging for a wide range of samples and research environments. Non-destructive X-ray imaging preserves and extends the use of valuable samples over time. The instrument achieves 0.9 µm true spatial resolution with minimum achievable voxel size of 100 nm. Advanced absorption and phase contrast (for soft or low-Z materials) increase versatility to overcome the limitations of traditional computed tomography approaches.

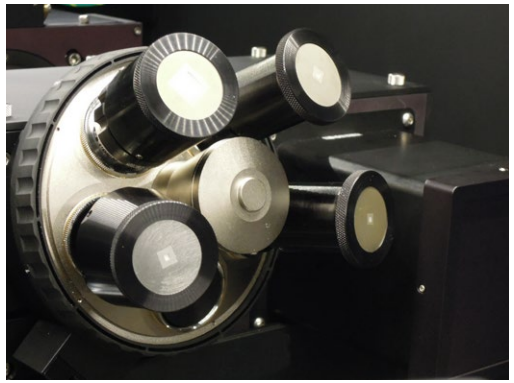
Performance Beyond Micro-CT
Xradia Versa solutions extend scientific research beyond the limits of projection-based micro- and nano-CT systems. Where traditional tomography relies on a single stage of geometric magnification, the Xradia 410 Versa features a unique two-stage process based on synchrotron-caliber optics. With flexible contrast, high ease of use, and breakthrough Resolution at a Distance (RaaD), Xradia Versa enable unprecedented lab-based exploration for a diverse array of applications, sample types and sizes. Multi-length scale capabilities enable imaging of the same sample across a wide range of magnifications.

Premier 4D / In Situ Solution
Non-destructive X-ray microscopes uniquely characterize the microstructure of materials in their native environments—*in situ*—as well as the evolution of properties over time (4D). RaaD capabilities enable the Xradia 410 Versa to maintain sub-micron resolution across a broad spectrum of sample dimensions in native environments and high-precision *in situ* rigs. The Xradia Versa *In Situ* Kit optimizes set-up and operation for high ease of use and faster time to results.

Your Insight into the Technology Behind It

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

Today's premier research requires three-dimensional insight into subjects in their native states, and as they evolve over time. World-leading research facilities, universities, synchrotrons, national and private labs have deployed X-ray microscopy (XRM) to meet the growing need for flexible, 3D/4D imaging at high resolution.



X-ray microscopy plays a vital role in your imaging workflow, delivering high resolution and contrast without destroying valuable samples for future use. Adding a non-destructive stage to the traditional workflow complements electron and optical techniques used in prominent labs worldwide, quickly identifying regions of interest for further study with destructive techniques.

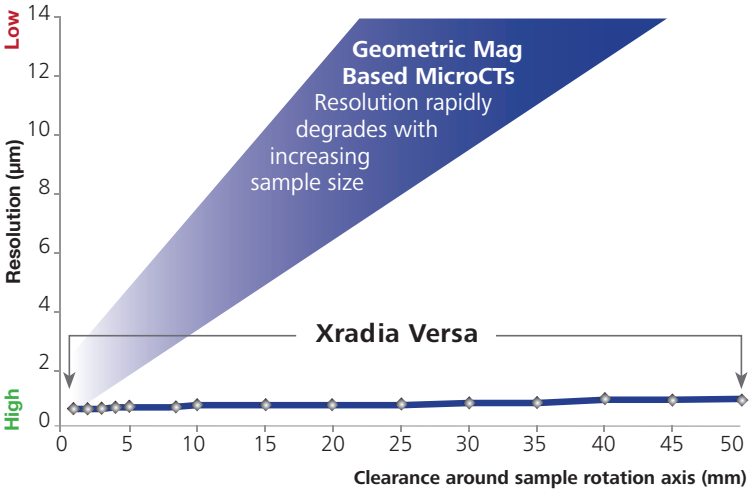
Xradia Versa solutions employ sophisticated X-ray optics developed for synchrotrons and a unique system architecture. Along with superior resolution and contrast, Xradia Versa deliver unique multi-length scale imaging, flexible working distances, and workflow efficiencies for a diverse array of applications and samples.

Your Insight into the Technology Behind It

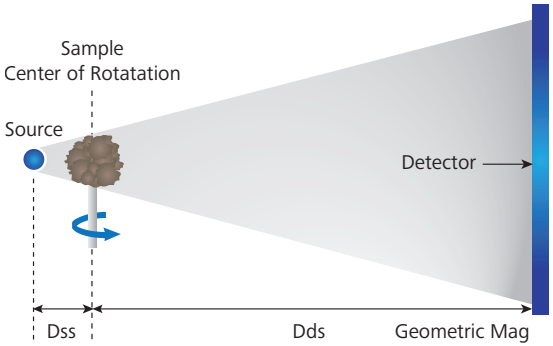
Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

ZEISS XRM: Architected for Advantage

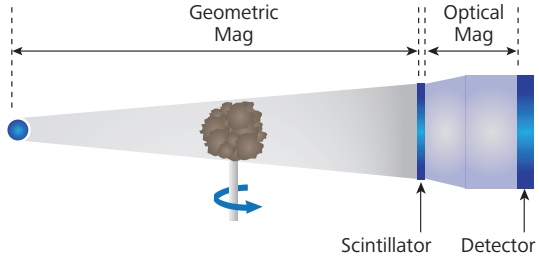
Xradia Versa architecture uses a two-stage magnification technique to uniquely achieve resolution at a distance (RaaD). Sample images are initially enlarged through geometric magnification as they are in conventional micro-CTs. In the second stage, a scintillator converts X-rays to visible light, which is then optically magnified. Reducing dependence upon geometric magnification enables Xradia Versa solutions to maintain submicron resolution at large working distances. This enables the widest range of sample sizes to be studied effectively, including within *in situ* chambers.



High resolution is maintained for large samples



Conventional Micro-CT Architecture

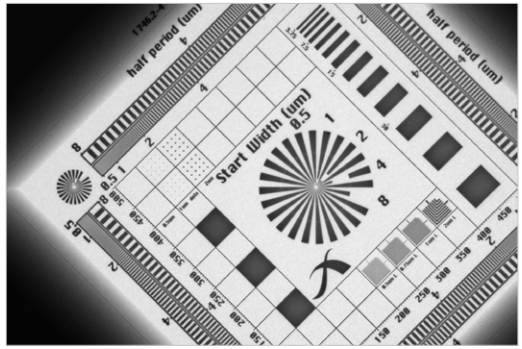


ZEISS XRM Two-stage Magnification Architecture

Your Insight into the Technology Behind It

Achieving True Resolution

Xradia Versa solutions deliver powerful 3D X-ray imaging, maintaining true submicron spatial resolution across varying distances, sample sizes, and environments. ZEISS XRM are specified on true spatial resolution, the most meaningful measurement of a microscope's performance.



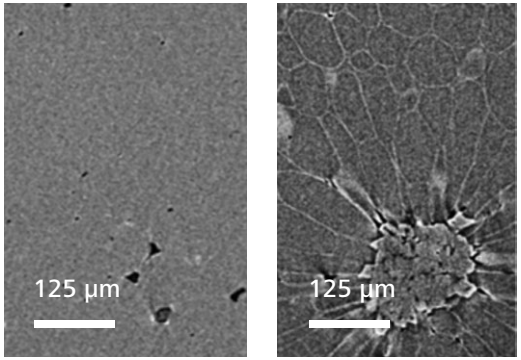
Spatial resolution refers to the minimum separation at which a feature pair can be resolved by an imaging system. It is typically measured by imaging a standardized resolution target with progressively smaller line-space pairs. Spatial resolution accounts for critical characteristics such as X-ray source spot size, detector resolution, magnification geometry, and vibrational, electrical and thermal stability. Other terms such as "voxel," "spot size," "detail detectability," and "nominal resolution" do not convey full system performance.

Your Insight into the Technology Behind It

An Edge In Contrast

Modern imaging requires superior contrast capabilities to reveal details needed to visualize and quantify features. Xradia Versa deliver flexible, high contrast imaging for even the most challenging materials—low atomic number (low Z) materials, soft tissue, polymers, fossilized organisms encased in amber, and other materials of low contrast.

Our comprehensive approach employs proprietary Enhanced Absorption Contrast Detectors that achieve superior contrast by maximizing collection of low energy photons while minimizing collection of contrast-reducing high energy photons. In addition, Tunable Propagation Phase Contrast measures the refraction of X-ray photons at material transitions to allow visualization of features displaying little or no contrast during absorption imaging.



Pear imaged with absorption contrast – no visibility of cell walls (left), and pear imaged with phase contrast, showing details of cell walls in normal cells and stone cells (right).

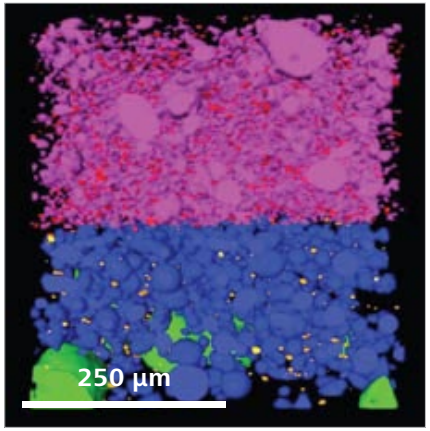
Tailored Precisely to Your Applications

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

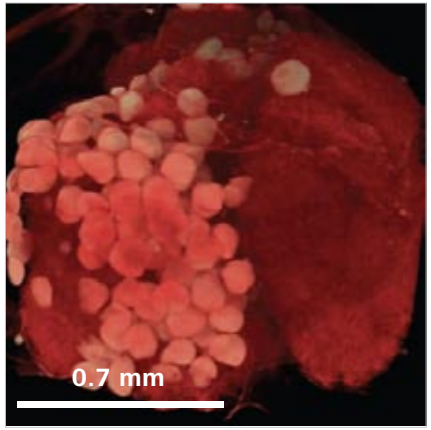
Typical applications	Task	Xradia 410 Versa offers
Pioneering Research	High definition imaging	Superior 3D resolution and contrast for a diverse range of applications
Material Science	Imaging and quantifying microstructure evolution in 3D and 4D (time-based)	RaaD, enabling in-situ experiments with submicron resolution across a large variety, including the interior regions, of material types and sizes
Life Science	Imaging developmental biology, pathology and neural network mapping	High contrast detector coupled with phase contrast imaging delivering unprecedented cellular-level detail
Geo Science	Studying porosity and and micro rock structures	The most accurate 3D, submicron characterization of rock pore structures for “digital rock” simulations and in-situ multiphase fluid flow studies
Electronics	Imaging of failures and microstructural details on large intact boards and advanced 3D packages	Industry’s highest resolution, non-destructive solution for submicron imaging

ZEISS Xradia 410 Versa at Work

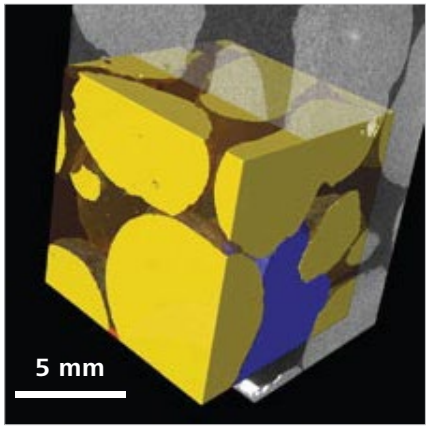
Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope



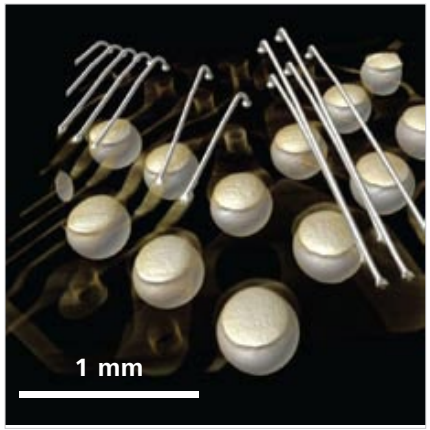
Material Science:
Composite material of polyurethane, EDPM, metal oxides and high melting explosive



Life Science:
Murine breast tissue



Geo Science:
Unstained water in Ottawa sand, imaged in a 12.5 mm diameter aluminum tube



Electronics:
Large flip chip (10x10x1 mm) imaged at high resolution

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

Your Flexible Imaging Solution

1 X-ray Microscope

- ZEISS Xradia 410 Versa with Resolution at a Distance

2 X-ray Source Options

- Light materials, closed reflection source (20 – 90 kV, maximum 8 W)
- High energy, closed reflection source (40 – 150 kV, maximum 10 W)
- High power, closed reflection source (40 – 150 kV, maximum 30 W)

3 Contrast-optimized Detectors

- Innovative dual-stage detector system with detector turret of multiple objectives at different magnifications with optimized scintillators for highest contrast.
- 2k x 2k pixel, noise suppressed charge-coupled detector

4 System Stability for Highest Resolution

- Granite base vibrational isolation
- Thermal environment stabilization
- Low noise detector
- Proprietary stabilization mechanisms

5 System Flexibility for Diverse Range of Sample Sizes

- Variable Scanning Geometry
- Tunable voxel sizes
- Absorption contrast mode
- Phase contrast mode
- Wide Field Mode (WFM) for increased lateral tomography volume with 0.4X objective
- Vertical Stitching for joining multiple tomographies vertically

6 Sample Stage

- Ultra-high precision 8-degrees of freedom sample stage
- 15 kg sample mass capacity

7 X-ray Filters

- Single filter holder
- Set of 12 filters included
- Custom filters available by special order

8 In Situ and 4D Solutions

- Resolution at a Distance enables superior *in situ* imaging
- Integrated *in situ* recipe control for Deben stages
- *In situ* interface kit option
- Custom in situ flow interface kit by special order

9 Instrument Workstation

- Power workstation with fast reconstruction
- Single CUDA-based GPU
- Multi-core CPU
- 24” display monitor

10 Software

- Acquisition: Scout-and-Scan Control System
- Reconstruction: XMReconstructor
- Viewer: XM3DViewer
- Compatible with wide breadth of 3D viewers and analysis software programs

Technical Specifications

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

Imaging	
Spatial Resolution	0.9 µm
Minimum Achievable Voxel* (Voxel size at sample at maximum magnification)	100 nm

* Voxel (sometimes referred to as "nominal resolution" or "detail detectability") is a geometric term that contributes to but does not determine resolution, and is provided here only for comparison. ZEISS specifies on spatial resolution, the most meaningful measurement of instrument resolution.

X-ray Source Options	Standard	High Energy	High Power
Voltage Range	20-90 kV	40-150 kV	40-150 kV
Maximum Power	8 W	10 W	30W

Detector System	
ZEISS X-ray microscopes feature an innovative detector turret with multiple objectives at different magnifications. Each objective features optimized scintillators that deliver the highest absorption contrast details.	
Standard Objectives	0.4X, 4X, 10X, 20X
Optional Objectives	40X

Stages	
Stage (load capacity)	15 kg
Stage Travel (x, y, z)	45, 100, 50 mm
Stage Travel (rotation)	360°
Source Travel (z)	350 mm
Detector Travel (z)	290 mm
Sample Size Limit	300 mm

Feature Comparison	520 Versa	510 Versa	410 Versa
Scout-and-Scan Control System	■	■	■
Automated Filter Changer	■		
High Aspect Ratio Tomography	■		
Dual Scan Contrast Visualizer	■		
Wide Field Mode	0.4X and 4X	0.4X	0.4X
GPU CUDA-based Reconstruction	Dual	Single	Single
In Situ Interface Kit	Optional	Optional	Optional

Count on Service in the True Sense of the Word

Xradia 410 Versa
Non-destructive high resolution, high contrast 3D X-ray microscope

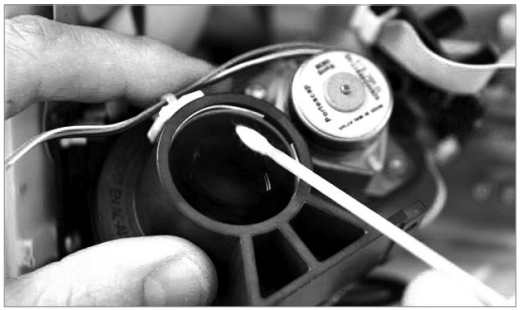
Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What's more, we'll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

Repair. Maintain. Optimize.
Attain maximum uptime with your microscope. A ZEISS maintenance contract lets you budget for operating costs, all the while avoiding costly downtime and achieving the best results through the improved performance of your system. Choose from service contracts designed to give you a range of options and control levels. We'll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization's standard practices.

Our standard preventative maintenance and repair on demand contracts also bring you distinct advantages. ZEISS service staff will analyze any problem at hand and resolve it – whether using remote maintenance software or working on site.

Enhance Your Microscope System
Your ZEISS microscope system is designed for a variety of updates. As a result you'll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.

Please note that our service products are always being adjusted to meet market needs and may be subject to change.



Profit from the optimized performance of your microscope system with a Carl Zeiss service contract – now and for years to come.

>> www.zeiss.com/microservice

The moment "I think" becomes "I know".

This is the moment we work for.

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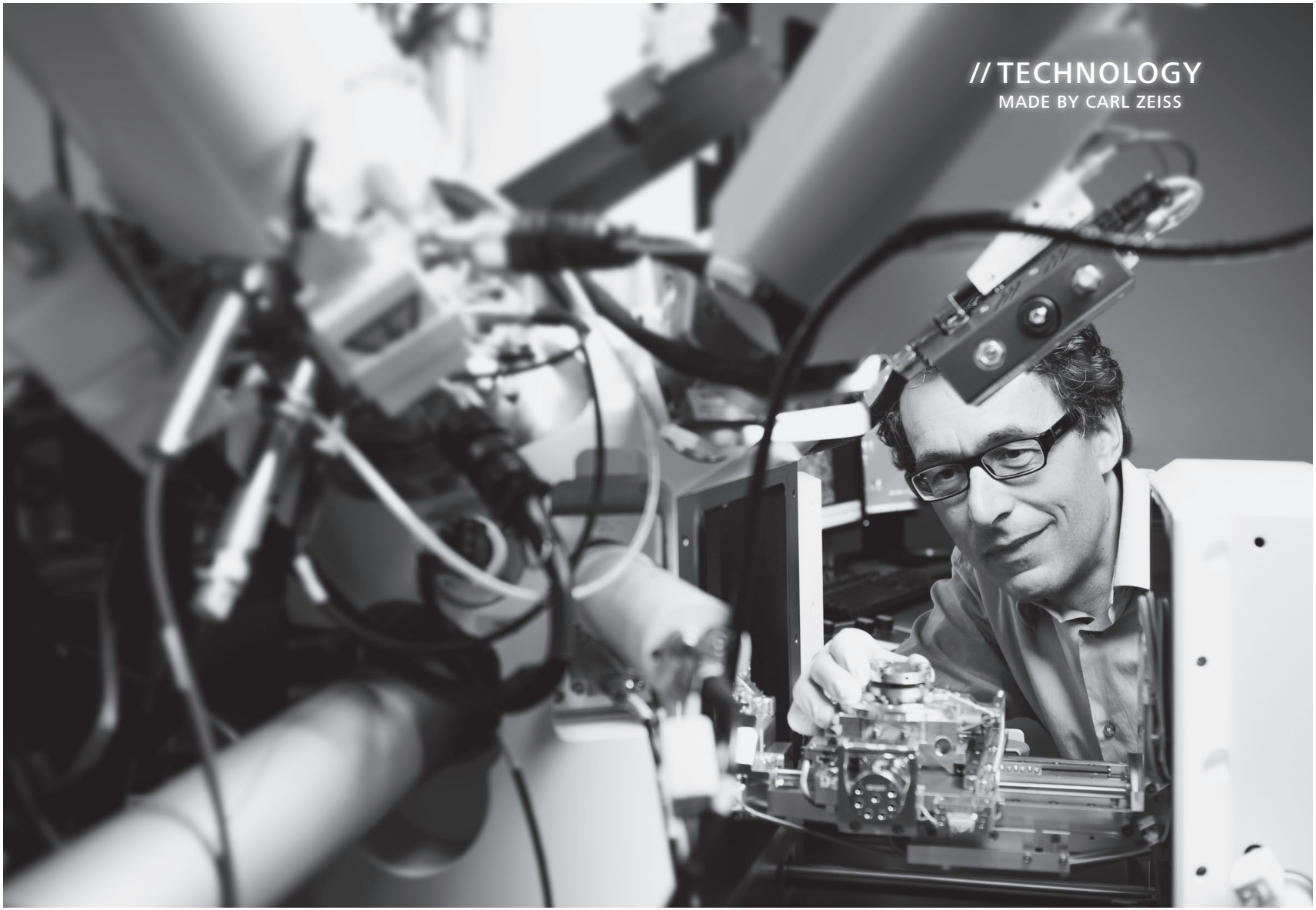

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